Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_ Period\_\_\_\_\_\_\_\_\_

**The Bowling Party**

Last Friday night Shanae and Thomas went bowling. Shanae was having a great time because she kept winning game after game. Poor Thomas. He could hardly move a pin.

Thomas decided that if he was going to improve his game, he would need more information about acceleration and force. First Thomas had to find the speed at which his ball and Shanae's were traveling. That part was easy. He knew that the bowling lane was 20 meters long. By careful observation he found that his ball took 3 seconds to hit the pins. Shanae's ball took 2 seconds.

1. At what average speed did Thomas's ball travel? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_6.67 m/s

2. At what average speed did Shanae's ball travel? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_10 m/s

Thomas also needed to know the force with which he and Shanae threw each ball. Maybe that was why Shanae kept getting better bowling scores. Thomas knew the formula for force: mass x acceleration. To find the acceleration, he needed to know the initial velocity, the final velocity, and the time the ball took to reach the final velocity. Both balls, of course, had an initial velocity of zero. Thomas found that it took Shanae's ball 1 second to reach its greatest velocity of 11 m/s. His own ball took 1 second to reach its greatest velocity of 7 m/s. Link this .idea to the concept of momentum. Greater initial force on the ball will result in greater velocity. Since momentum equals mass times velocity, a bowling ball with higher velocity will have greater momentum than one with lower velocity.

3. What was the acceleration of Shanae's ball? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. What was the acceleration of Thomas's I\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Now Thomas was able to find the force. He already knew the mass of each bowling ball, 6 kg. What was the force that Shanae used to give her ball its acceleration? Your answer will be expressed in newtons. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. What was the force applied to the ball that Thomas threw? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. Why wasn't Thomas winning?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. Thomas knew that he would have to give more acceleration to the ball if he wanted to win some games from Shanae. How could he do that? Use Newton's second law of motion to explain your answer. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11 mlsls

7 mlsls

66 N c

42 N

He wasn't using as much force as Shanae to get the ball moving.

Newton's second law states that force is the product of mass and ball.